

A NEW SPECIES OF MEKOSUCHINE CROCODILIAN FROM THE MIDDLE PALAEOGENE RUNDLE FORMATION, CENTRAL QUEENSLAND

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Holt, T.R., Salisbury, S.W. & Willis, P.M.A. 2005 01 10: A new species of mekosuchine crocodilian from the middle Palaeogene Rundle Formation, central Queensland. *Memoirs of the Queensland Museum* 50(2): 207-218. Brisbane. ISSN 0079-8835.

A new species of mekosuchine crocodilian is described from the middle Palaeogene Rundle Formation, near Gladstone. *Kambara molnari* sp. nov. is the third species of *Kambara* to be recognised in the Australian Palaeogene. The holotype comprises the caudal two thirds of a left mandibular ramus. Referred material includes several fragmentary osteoderms, a proximal phalanx and a procoelous vertebral corpus. Similar to *K. murgonensis*, when complete, the mandibular ramus of *Kambara molnari* had 17 dentary alveoli and 2 shallow, rostrocaudally elongate pits lateral to the articular fossa on the dorsolateral surface of the surangular. Unlike *K. implexidens*, the retroarticular process is 3 times longer than wide in dorsal view, and the retroarticular fossa is divided into 2 smaller fossae by a low, sagittally aligned ridge. The 10th-12th alveoli are confluent. Occlusal grooves for the reception of maxillary pseudocanines are lateral to a point midway between the 7th and 8th, and the 8th and 9th alveoli. Reception pits for maxillary teeth occur between the 12th-17th alveoli. These pits and grooves indicate a partial interlocking occlusal pattern. The partially interlocking occlusal pattern in 2 species of *Kambara* and an indeterminate early Palaeogene crocodilian from Runcorn, SE Queensland, as well as a sagittally aligned ridge on the retroarticular fossa in *K. molnari*, indicate a close taxonomic affinity between Mekosuchinae and Crocodylidae. □ *Rundle Formation, Kambara, Eocene, Eusuchia, Crocodyloidea, Mekosuchinae.*

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The origin of Mekosuchinae, a uniquely Australasian group of Cenozoic eusuchian crocodilians, is still unclear. In this regard, fossils from middle Palaeogene deposits play a key role. Prior to the Cenozoic, only fragments from unrelated crocodylomorphs of the Lower Cretaceous deposits at Lightning Ridge (Etheridge, 1917; Molnar, 1980; Molnar & Willis, 2001), southern Victoria (Riech & Vickers-Riech, 1998; Riech, 1996; Vickers-Riech, 1996) and the Winton Formation, near Isisford, Queensland (Molnar & Willis, 1996) have been reported. *Kambara murgonensis* (Willis et al., 1993) and *K. implexidens* (Salisbury & Willis, 1996) are the only described species of mekosuchines from the early Palaeogene. Both come from deposits near Murgon, SE Queensland (Salisbury & Willis, 1996). The importance of *Kambara* is indicated by the fact that the description of *K. murgonensis* was used in conjunction with the formal naming of the 'Australian radiation of crocodilians' (Willis et al., 1990) as Mekosuchinae (Willis et al., 1993). *Kambara* is the most plesiomorphic of all mekosuchines so far described. Another as yet,

unnamed early Eocene crocodilian from the Corinda Formation at Runcorn, SE Queensland was recorded by Willis & Molnar (1991a). It remains unnamed due to the limited, fragmentary material. Another possible early Eocene crocodilian is presented by Riech (1952) but the impressions of skin may not to be of crocodilian origin, and the bone fragments that Riech (1952) described unfortunately seem to have been misplaced (Molnar, 1991). McNamara (1993) also reported on the occurrence of crocodilian osteoderms within the Eocene or possibly early Oligocene vertebrate assemblages from Cape Hillsbrough, north of Mackay.

Herein we describe *Kambara molnari* sp. nov. based on a partial left mandibular ramus from a once 3-4m long crocodilian. The holotype derives from the Rundle Formation, near Gladstone. The first note of crocodilian material from the Rundle Formation was by Hills (1943) who mentioned a digital phalanx (GSQF1972e) and 4 osteoderms (GSQF1972a-d) from what he presumed was a single individual. No additional material was recorded until 1982, when L. Coshell of the Esso oil company found the

QMF12364, presumably during mining operations. This specimen was first mentioned and figured by Molnar (1991), but it was not until Salisbury & Willis (1996) analysis of *Kambara* that comparison with other taxa was conducted. Willis & Molnar (1991) reported on a vertebral corpus (QMF12363) from the Rundle Formation. At the time of writing, this specimen could not be located.

Institutional Abbreviations. Prefixes for specimen numbers indicate the following institutions: AR, Archer collection, University of New South Wales, Sydney; GSQ, Geological Survey of Queensland vertebrate collection, Queensland Museum, Brisbane; NTM, Northern Territory Museum, Darwin; SAM, South Australian Museum, Adelaide. QMF, Queensland Museum; UQF, Dept of Earth Sciences, University of Queensland.

Anatomical Nomenclature. We follow the nomenclature of Frey (1988), Rauhe (1993), Witmer (1995), Rossmann (2000), Salisbury et al. (1999) Salisbury (2001), Salisbury & Frey (2001) and Salisbury et al. (2003). Tooth orientation follows Smith & Dodson (2003).

STRATIGRAPHY AND AGE

The geology of The Narrows Graben near Gladstone was first described by Ball (1914, 1946). A more detailed geology was provided by Henstridge & Missen (1982) and Henstridge & Coshell (1984). The Rundle Formation consists of 7 oil shale seams and interbedded claystones, indicating a freshwater sequence. Three paleoenvironments are identified in the Narrows Graben: an alluvial fan (Worthington Beds), lagoonal mud flats (Rundle Formation) and limnic swamps (Curlew Formation). Stratigraphically, the Rundle Formation is subdivided into 7 seams (Fig. 1). The Brick Kiln Seam is most likely to have contained the crocodylian material, although this cannot be confirmed. A dolerite dyke intersects the Brick

Kiln Seam and has been K/Ar dated at 26.8 Ma (Henstridge & Missen 1982). Foster (1979) assigned a late Eocene to late Oligocene age based on microspore analysis. Henstridge & Missen (1982) concluded that the best estimate is middle to late Eocene. In addition to crocodylians, the fauna associated with the Rundle Oil Shale includes ostracods, gastropods, fishes and turtles. Oil has been extracted from the Rundle and adjacent Stuart Oil-shales (Moody, 1992).

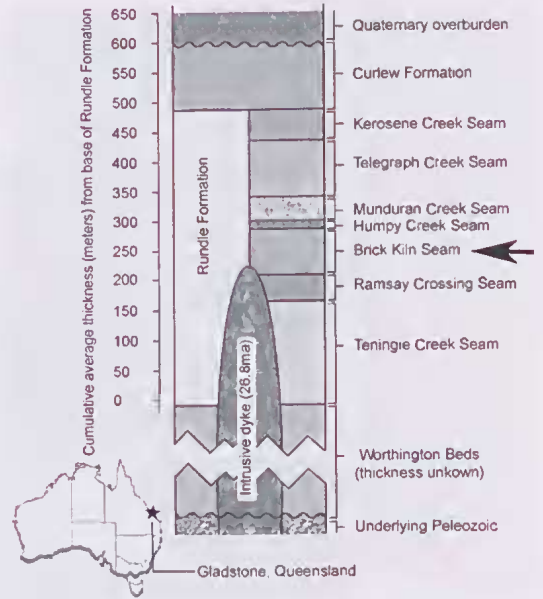


FIG 1. Idealised stratigraphic section of the Narrows Graben showing horizon containing crocodylian material (arrowed).

SYSTEMATIC PALAEOLOGY

- Order CROCODILIA Gmelin, 1700
- Suborder EUSUCHIA Huxley, 1875
- Superfamily CROCODYLOIDEA Cuvier, 1807
- Family INCERTAE SEDIS
- Subfamily MEKOSUCHINAE Balouet & Buffetaut, 1987
- Kambara* Willis et al., 1993**

TYPE SPECIES. *Kambara murgonensis* Willis et al., 1993.

DIAGNOSIS. See Salisbury & Willis (1996).

Kambara murgonensis

HOLOTYPE. QMF21115, an almost complete skull from Tingamarra Station, near Murgon, SE Queensland.

REVISED DIAGNOSIS. As in Salisbury & Willis (1996) with the following amendments: Two long, shallow rostrocaudally elongate pits lateral to the articular fossa on the dorsolateral surface of the surangular.

Kambara implexidens

HOLOTYPE. QMF29662, an almost complete skull from Boat Mountain near Murgon.

REVISED DIAGNOSIS. As in Salisbury & Willis (1996) with the following amendments: surangular lateral to the articular fossa smooth.

***Kambara molnari* sp. nov.**
(Figs 2-5, 7, 8)

ETYMOLOGY. The species name honours Ralph E. Molnar for his contribution to the understanding of Australia's fossil crocodylians.

HOLOTYPE. QMF12364, a partial left mandibular ramus from The Narrows near Gladstone in the Brick Kiln Seam of the Rundle Formation.

REFERRED MATERIAL. GSQF1972a-d, fragmentary osteoderns; GSQF1972e, proximal phalanx; QMF12363, vertebral corpus.

OTHER MATERIAL. Hills (1943) described several fragmentary osteoderms (GSQ QMF1972a-d) and a proximal phalanx (GSQ QMF1972e). It is assumed that this material can be referred to *K. molnari*. This posterianal material offers little additional information.

DIAGNOSIS. Seventeen dentary alveoli; 2 shallow, rostrocaudally elongate pits lateral to the articular fossa on the dorsolateral surface of the surangular; retroarticular process approximately 3x longer than it is wide in dorsal view; retroarticular fossa divided into 2 fossae by a shallow, sagittally aligned ridge; oclusal grooves for the reception of maxillary pseudocanines lateral to a point midway between the 7th and 8th, and the 8th and 9th alveoli; reception pits for maxillary teeth between 12th-17th alveoli; 10th-12th dentary alveoli confluent.

DESCRIPTION. *Preservation.* The holotype is the caudal 2/3 of a left mandibular ramus, comprising all of the dentary caudal to the 7th alveolus the majority of the angular, all of the surangular, the caudal portion of the articular dorsal to the articular fossa and the rostral portion of the splenial (Figs 2, 3). The fragmented specimen has been consolidated using epoxy resin and 2 wooden stick supports along its medial side. The coronoid and mandibular symphysis are not preserved. There are 5 teeth in the dentary.

Osteology. General form. Elongate left mandibular ramus, roughly triangular in both lateral and medial view (Figs 2, 3); length approximately 3.5 × the highest point at the caudal end of the specimen in lateral view; maximum caudal height approximately 5 × minimum rostral height; tooth row extending to about half way along the specimen; external mandibular fenestra oval, positioned half way between the tooth row and the retroarticular process, with long axis at 26° to the horizontal plane, bounded by the dentary, surangular and

angular; extensive sculpture pitting on the lateral surface in the area caudal to the external mandibular fenestra.

Dentary. Seventeen alveoli [numbering of alveoli based on comparisons with *Crocodylus porosus* and other *Kambara* (Salisbury & Willis, 1996; Willis et al., 1993)]; dentary festooned vertically in lateral view; highest part of the dentary (i.e., the second 'dentary crest') between the 9th and 10th alveolus, and 1.5 × higher than at 7th alveolus (i.e., the lowest part of the dentary); margins of the 7th and 8th alveoli raised slightly and positioned laterally in dorsal view; oclusal grooves for reception of maxillary pseudocanines lateral to a point midway between the 7th and 8th, and the 8th and 9th alveoli (Fig. 4); 10th-12th alveoli confluent with each other (Fig. 5); 15th-17th alveoli on the medial margin of the dentary, along the contact with the splenial. Reception pits for maxillary teeth between the 12th-17th alveoli (Fig. 5).

Alveoli similar in mesiodistal length and linguolabial width except for the 16th and 17th (possibly due to the incompleteness of these two alveoli); size of alveoli variable (Fig. 6); 10th-12th alveoli largest, nearly twice size of caudal alveoli.

Longitudinal sulcus on the rostralateral surface of the dentary, extending from the surangulodentary suture, to the 14th alveolus; dentary forming the dorsorostral portion of the external mandibular fenestra, extending nearly to the dorsocaudal-most angle; suture with the surangular serrated along the dorsal portion of the ramus, extending from the 17th alveolus to the caudal apex of the external mandibular fenestra; along the ventral margin, the planar dentroangular suture extends to the 15th alveolus; nutrient foramina numerous on the lateral side of the dentary.

Angular. Angular almost complete, lacking only its rostromedial portion; angular forms the caudoventral portion of the external mandibular fenestra, extending ventrally along the gently concave dentroangular fossa to the 15th alveolus from the rostroventral point of the external mandibular fenestra; dorsal margin parallel to ventral margin rostrally, becoming gradually aligned caudally with the dorsal margin of the retroarticular process; heavy sculpture pitting caudal to the external mandibular fenestra; two small (3.5mm diameter), rostrocaudally aligned nutrient foramina on the ventral surface, the first of which is in line with the caudal apex of the

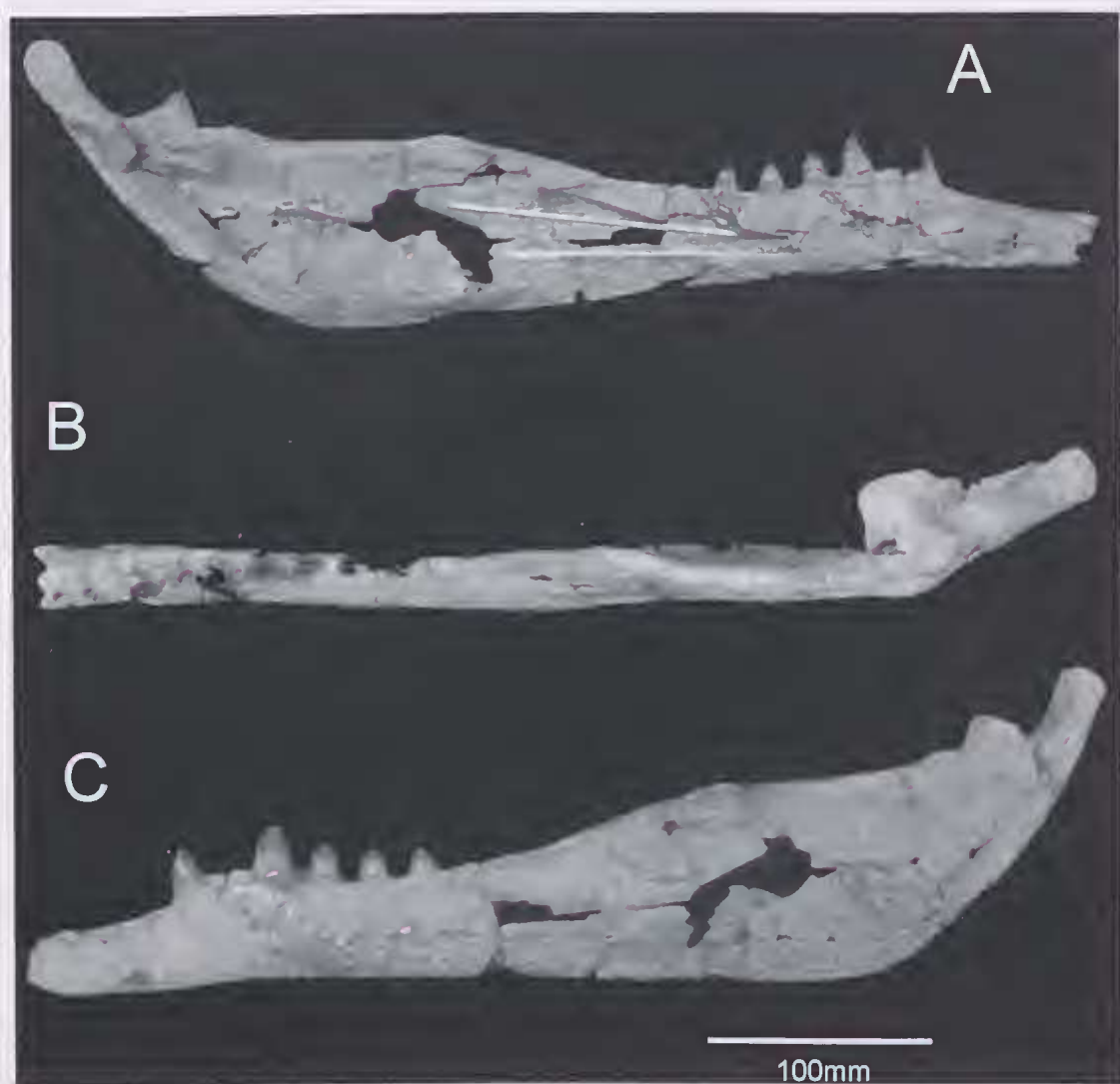


FIG. 2. *Kambara molhari* sp. nov., holotype. Left mandibular ramus in medial (A), dorsal (B) and lateral (C) view.

external mandibular fenestra in either lateral or medial view.

Surangular. Complete, except for a few minor pieces; caudal portion contributing to the lateral side of the retroarticular process; dorsal surface parallel to the ventral edge of the tooth row, to the 17th alveolus; ventral edge of the surangular participates in the suranguloangular suture; articular groove on the dentary corresponds with the missing triangular portion of the surangular, slightly ventral to the dorsal margin; surangular forming the dorsocaudal apex of the external mandibular fenestra, contributing to 10% of its

border; 2 elongate pits on the dorsocaudal surface lateral to the articular fossa (Fig. 7); caudal pit in line with the articular fossa; rostral pit more elongate and 3 times longer than it is wide in a rostrocaudal direction; caudal pit twice as long as it is wide; heavy pitting on the lateral surface between the external mandibular fenestra and the retroarticular process; small foramen situated 1/3 of the way between the tooth row and the retroarticular process surface, forming a continuation of the sulcus on the dorsal surface of the dentary; surangular forms a planar rostroventral suture with the dentary; suture extends rostrally from the caudal apex of the external mandibular

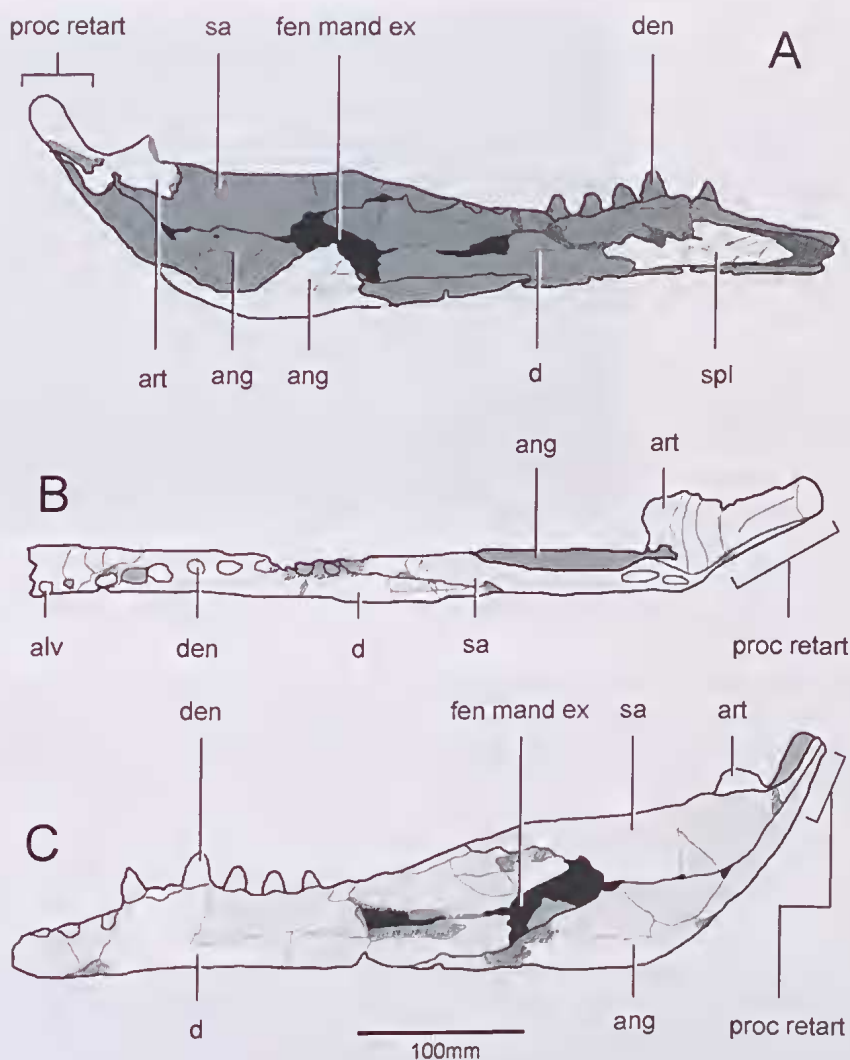


FIG. 3. *Kambara molnari* sp. nov.; Schematic interpretation of the holotype left mandibular ramus. ang= angular; alv= alveoli; art= articular; d= dentary; fos art mand= articular fossa; fos retart= retroarticular fossa; fen mand ext= external mandibular fenestra; proc retart= retroarticular process; sa= surangular; spl= splenial; den= tooth.

fenestra to a point level with the dorsal base of 17th alveolus.

Articular. Fragmentary; portion participating in both the articular fossa and the retroarticular fossa remains; articular forms the medial part of the retroarticular process; retroarticular process approximately $2 \times$ as high as the caudal wall of the articular fossa in lateral view; articular fossa subrectangular in dorsal view; lateral margin approximately $2 \times$ the size of the medial margin; long axis of the articular fossa aligned at approximately 80° to the median plane; siphonal

foramen not evident as portion of the articular in which it would occur is not preserved; retroarticular fossa divided by a low, sagittally aligned ridge (Fig. 7); sutures with angular and surangular planar.

Splenial. Preserved portion from 7th-11th alveoli and along the ventral half of the ramus to the 14th alveolus; rostral surface tapering gently, extending to the 7th dentary tooth (Fig. 8); medial surface of the splenial smooth, with a few nutrient foramina ventrally; splenial foramen not preserved; indentations on the medial surface of

the dentary indicate that the splenial continues to a point close to the 6th alveolus [based on comparison with other *Kambara* specimens (Salisbury & Willis, 1996)]; unlikely that splenial participates in the mandibular symphysis; splenial forms medial margin of the tooth row from the 13th to the 17th alveoli.

Teeth. Present in the 10th and 12th-15th alveoli; 10th and 12th teeth are pseudoanines, considerably larger than the others; 13th-15th teeth smaller and more peg-like; earinae present on mesial and distal margins of all teeth.

COMPARISONS. *Referral to Kambara.* The osteology of QMF12364 compares best with material referred to *Kambara*. In light of these similarities, in addition to the skeletonised remains of all species of extant crocodylians and other crocodylian remains from the Australian Palaeogene [namely the Runcorn crocodylian; (Willis & Molnar, 1991a)], QMF12364 was compared with *Australosuchus clarkae* (Willis & Molnar, 1991b), *Pallimnarchus* (Molnar, 1982; Willis & Molnar, 1997), *Baru* (Willis 1997;

Willis et al., 1990); *Trilophosuchus rackhami* (Willis, 1993), *Quinkana* (Megirian, 1994, Molnar, 1981; Willis, 1997; Willis & Mackness, 1996), *Mekosuchus* (Balouet & Buffetaut, 1987; Mead et al., 2002; Willis, 1997, 2001), *Volia athollandersoni* (Molnar et al., 2002) and *Harpacochampsia campsfieldensis* (Megirian et al., 1991). The diagnosis of *Kambara* (Willis et al., 1993) was based on the description of the type species and was later emended (Salisbury &

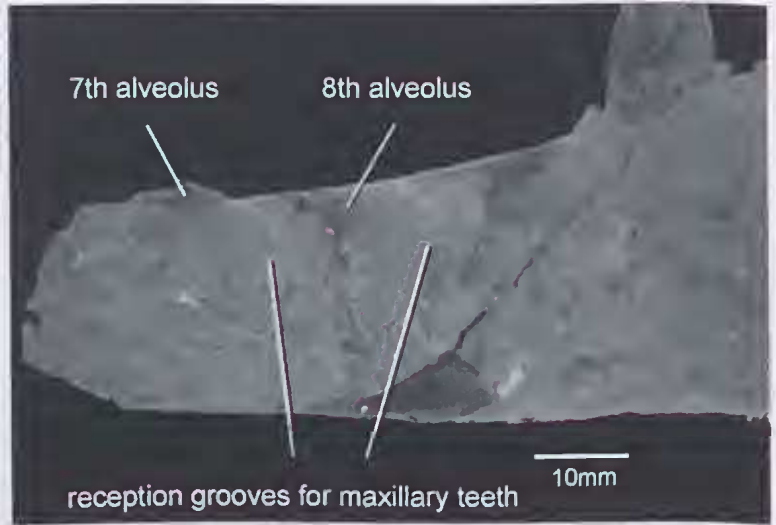


FIG. 4. *Kambara molnari* sp. nov., holotype. Lateral view of the rostral portion of the dentary, showing the 7th and 8th alveoli and their corresponding occlusal grooves for maxillary teeth. Rostral is to the left.

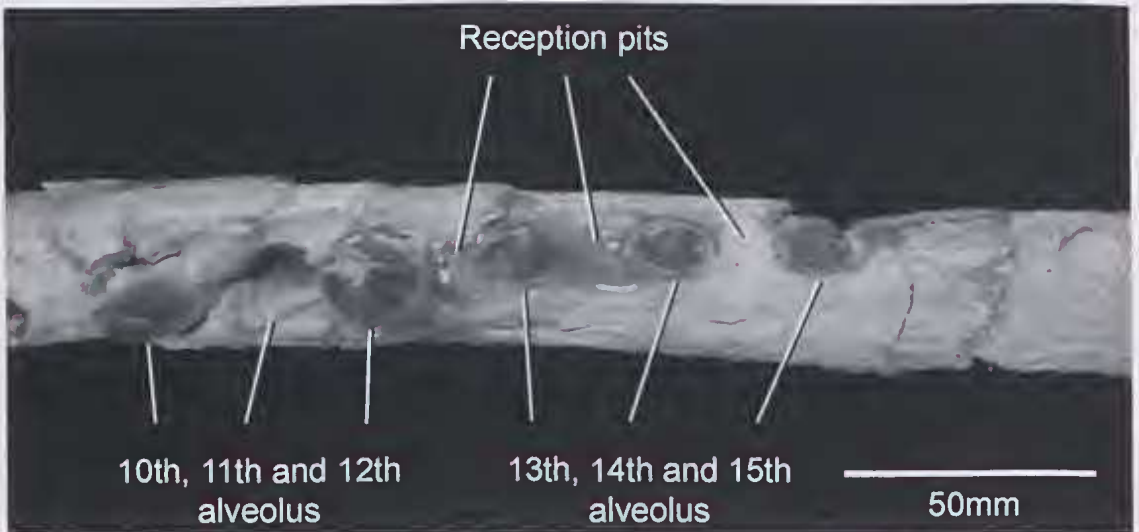


FIG. 5. *Kambara molnari* sp. nov., holotype. Dorsal view of the 9th-17th alveoli, showing confluent 10th-12th alveoli and reception pits for maxillary teeth. Rostral is to the left.

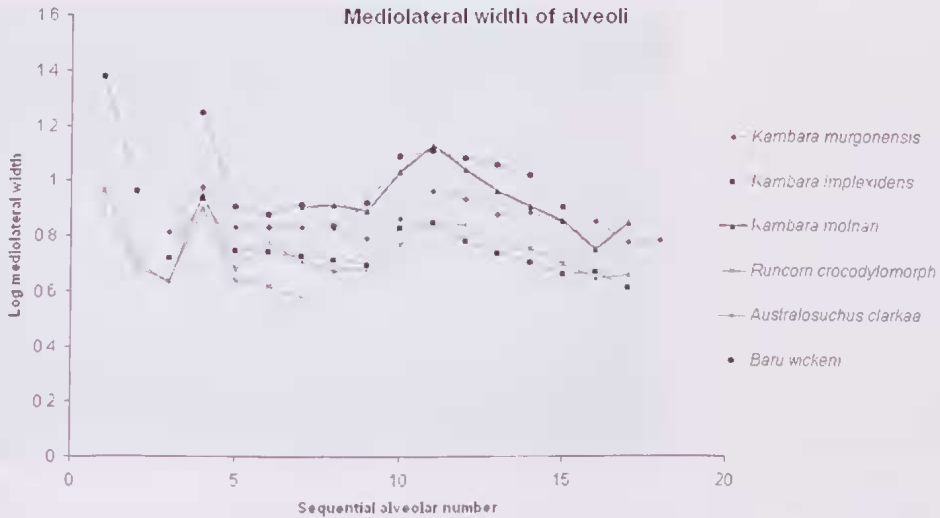


FIG. 6. Graph showing the log transformed width of alveoli in closely related early crocodyloids. Specimens based on: *Kambara murgonensis* (QMF29666); *K. implexidens* (QMF21116); *K. molnari*; (QMF12364); Runcorn crocodylomorph (UQF73195); *Baru wickeni* (NTMP861-14); *Australosuchus clarkae* (QMF18152). Reproduced from Salisbury (1994).

Willis, 1996) following recognition of *K. implexidens*. In relation to QMF12364, these diagnostic features include: medium sized, moderately broad-snouted; mandibular symphysis extending caudally to between the 6th and 7th dentary alveoli; splenial extending anteriorly to between the 6th and 7th dentary alveoli but not entering the mandibular symphysis; 17-18th dentary alveoli; teeth slightly compressed transversely with distinct anterior and posterior carinae. Salisbury & Willis (1996) listed 3 other features of the mandible of *K. implexidens* that they thought diagnostic of the genus pending collection of additional material of *K. murgonensis*: articular fossa deeply notched laterally; short retroarticular process; medial wall of retroarticular fossa concave.

In dorsal view, the preserved tooth row of QMF12364 is in the same plane as the caudal half of the mandibular ramus. This indicates a generalised brevirostrine skull, with proportions similar to the holotype skull of *K. murgonensis* (as opposed to a

shorter rostrum, where the medial angle between the tooth row and the caudal half of the ramus would be considerably $<180^\circ$). Similar to *K. murgonensis* and *K. implexidens*, QMF12364 has 17 dentary alveoli. The morphology of the teeth and the pattern in the width of the dentary alveoli up to the 9th alveolus (Fig. 6) are also similar. In *K. implexidens*, the 10th and 11th alveoli are approximately the same size, with the remainder being considerably smaller. In *K. murgonensis* and QMF12364, the 10th alveolus is smaller than the 11th and 12th. The 11th and

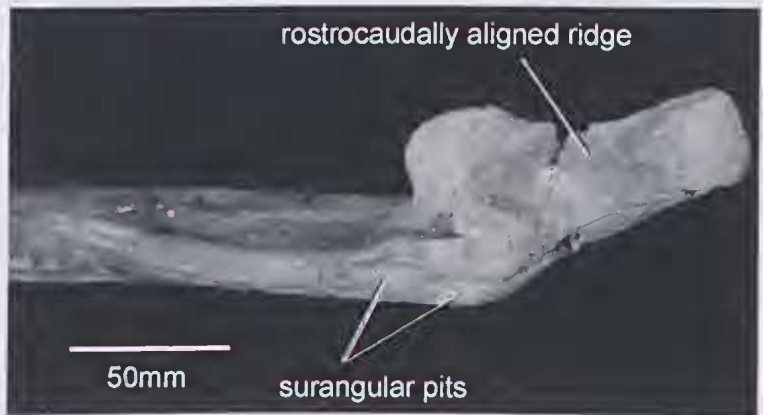


FIG. 7. *Kambara molnari* sp. nov., holotype. Dorsal view of the angular and the caudal portion of the surangular, showing the two surangular pits and the rostrocaudally aligned ridge. Rostral is to the left.

12th are also similar in size, and there is a corresponding decrease in size in the caudal most portion of the tooth row. The major difference between *K. murgonensis* and QMF12364 is in the middle of the dentary (the 10th-12th alveoli). In *K. murgonensis*, the 10th alveolus is closer in size to the 9th, whereas in QMF12364, the 11th is closer in size to the 10th.

The mandibular rostrum is not preserved in QMF12364. Nevertheless, the splenial extended rostrally to a point that is at least level with the caudal margin of the 6th dentary alveolus. Such a condition is consistent for *Kambara*.

In light of these similarities and its close geographical and temporal occurrence, we feel confident in assigning QMF12364 to *Kambara*.

DIAGNOSTIC OSTEOLOGICAL FEATURES. Differences between *K. molnari* and other material assigned to *Kambara* that warrant specific designation include the following.

Occlusal Pattern. A major distinguishing features between *K. murgonensis* and *K. implexidens* relates to the way in which the jaws occlude (Salisbury & Willis, 1996). In *K. murgonensis*, the dentary teeth occlude medial to the rostral teeth, whereas in *K. implexidens* they interlock (Salisbury & Willis, 1996). *Kambara molnari* shows what could be considered an intermediate condition. The margins of the 7th and 8th alveoli in *K. molnari* are raised slightly (Fig. 4), with occlusal grooves for maxillary teeth on the lateral surface of the dentary, at positions midway between adjacent alveoli. This indicates that at least in this portion of the rostrum, there was interlocking dentition with the rostral-most maxillary teeth. Reception pits between some of the caudal-most alveoli (12th-17th) also suggest that the teeth interlocked in this part of the rostrum. On the other hand, the 10th-12th alveoli are confluent (Fig. 5), indicating that in this part of the rostrum, the maxillary teeth occluded lateral to those of the dentary. The resulting inferred occlusal pattern is therefore different to those present in either *K. murgonensis* and *K. implexidens*, and is more reminiscent of that seen in several types of Palaeogene crocodyloids and

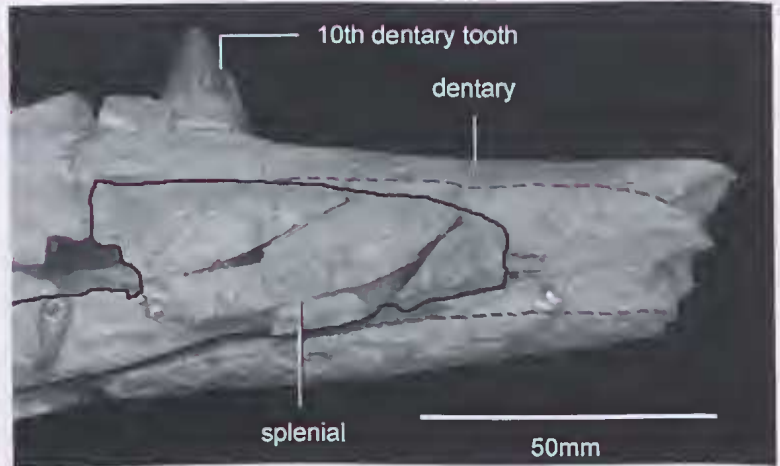


FIG. 8. *Kambara molnari* sp. nov., holotype. Medial view of the splenial. Broken line indicates probable splenial continuation. Rostral is to the right.

some species of *Borealosuchus* (*Leidyosuchus*) (Brochu, 1997) and *Diplocynodon* (Brochu, 1999).

Osteology of the Retroarticular Process and the Articular. The articular and associated retroarticular process is not well known for *Kambara*. The only other specimen besides QMF12364 to have part of the articular preserved is the paratype mandible of *K. implexidens* (QMF30077) (Salisbury & Willis, 1996, figs 8, 9). Based on this specimen, Salisbury & Willis (1996) considered a short retroarticular process as possibly diagnostic of the genus.

In *K. molnari*, the retroarticular process is approximately 3× as long in a rostrocaudal direction as it is wide in dorsal view; a condition that could not be described as 'short'. Salisbury & Willis (1996) also noted that unlike *K. implexidens*, the retroarticular fossa of *K. molnari* was divided into 2 smaller fossae by a sagittally aligned ridge (Fig. 8), similar to the condition seen in *Crocodylus*.

It has also been suggested that the medial wall of the retroarticular fossa being concave may be diagnostic of *Kambara* (Salisbury & Willis, 1996). This hypothesis is again based on the paratype mandible of *K. implexidens*. *K. molnari* also shows this feature (Fig. 7). Therefore while still diagnostic, this feature is no longer restricted to *K. implexidens*.

Surangular Pits. The presence of 2 small pits on the surangular of *K. murgonensis* was used as a diagnostic feature of that species by Salisbury & Willis (1996). Similar pits occur in *K. molnari* (Fig. 7). There was no mention in the description of *Anzurosuchus clarkae* of these pits (Willis &

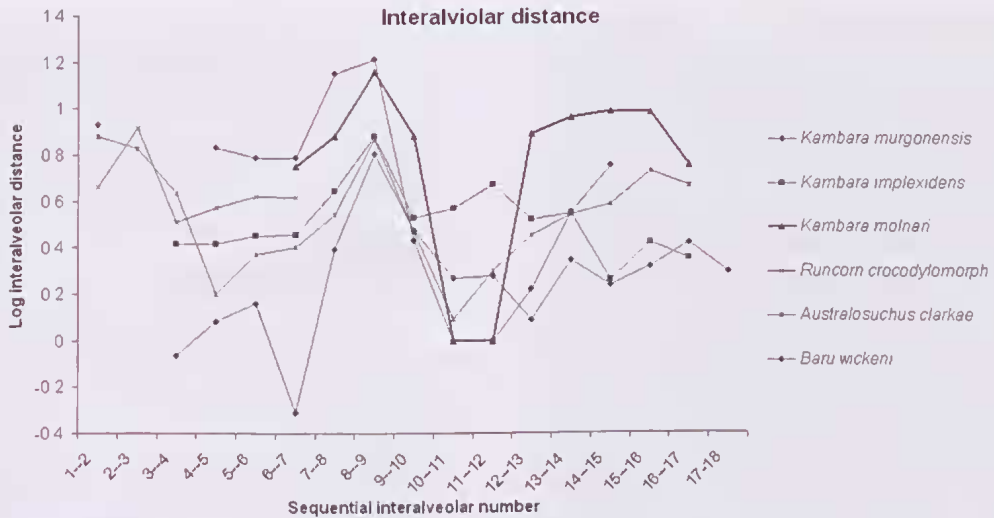


FIG. 9. Graph showing the log transformed interalveolar distances of the holotype of *Kambara molnari* (QMF12364) and other closely aligned crocodyloids. Specimens based on: *Kambara murgonensis* (QMF29666); *K. implexidens* (QMF21116); *K. molnari* (QMF12364); Runcorn crocodylomorph (UQF73195); *Baru wickeni* (NTMP861-14); *Australosuchus clarkae* (QMF18152). Reproduced from Salisbury (1994).

Molnar, 1991b). These pits in a closely related genus may indicate that *K. implexidens* was more plesiomorphic than the other 2 species (as it lacks these pits). We have revised the diagnostic value of these pits, so as to not be confused with the heavy sculpture pitting also present on the surangular.

TAXONOMIC CONCLUSIONS. Based on features discussed above, we erect *Kambara molnari* sp. nov. and distinguish it by: 1) 17 dentary alveoli; 2) 2 shallow, rostrocaudally elongate pits lateral to the articular fossa on the dorsolateral surface of the surangular; 3) retroarticular process approximately 3 × longer than it is wide in dorsal view; 4) retroarticular fossa divided into 2 fossae by a shallow, sagittally aligned ridge; 5) occlusal grooves for the reception of maxillary pseudocanines lateral to a point midway between the 7th and 8th, and the 8th and 9th alveoli; 6) reception pits for maxillary teeth between the 12th-17th alveoli; 7) 10th-12th alveoli confluent.

DISCUSSION

The recognition of a third species of *Kambara* at Rundle, near Gladstone on the central Queensland coast, extends the range of this genus approximately 250km farther north. Previously, Boat Mountain, near Murgon was the only recorded location for *Kambara*. Although it is

unlikely that *K. molnari* was contemporaneous with *K. murgonensis* and *K. implexidens*, its discovery points to high species level diversity for *Kambara* during the Eocene.

Similarities between the depositional environments in which all three species were found additionally indicate that like other mekosuchines, *Kambara* was probably restricted to freshwater habitats. During the early Tertiary, it seems likely that species of *Kambara* were found throughout the inland waterways of Queensland, if not all of eastern Australia if temperature conditions permitted. This distribution is similar to that of *Crocodylus johnstoni* in northern Australia today.

Kambara molnari shows features of both *K. implexidens* and *K. murgonensis*. Salisbury & Willis (1996) considered the interlocking dentition seen in *K. implexidens* to be convergent on the condition found in crocodylids and closely allied taxa such as *Brachyranochampsa* and *Harpacochampsa camfieldensis*. In this light, the overbite seen in *K. murgonensis* and other mekosuchines was considered the ancestral condition for the group. However, the partially interlocking occlusal pattern in *K. molnari* suggests that the condition in *K. implexidens* is not as unusual as initially thought. UQF73195, a rostral dentary fragment from the early Tertiary (late Palaeocene or early Eocene) of Runcorn, SE Queensland also shows features indicative of an

interlocking occlusal pattern (Salisbury & Willis, 1996; Willis & Molnar, 1991a). As was suggested by Salisbury & Willis (1996) and later supported by the phylogenetic analysis of Brochu (2001) (based on *Australosuchus clarkae*), the interlocking occlusal pattern (or at least partial) in 3 taxa of early Tertiary Australasian crocodylians may indicate a close taxonomic affinity between Mekosuchinae and Crocodylidae.

The sagittally divided retroarticular fossa in *K. molnari* is a feature only known for *Crocodylus* (Norell & Clark, 1990) and possibly '*Crocodylus clavis*' (Norell & Storrs, 1998). In extant crocodylians, the retroarticular fossa serves as the point of insertion for the *m. depressor mandibular*, the primary muscle responsible for jaw opening (Busbey, 1989; Schumacher, 1973). The low, sagittally aligned ridge on the retroarticular fossa, as in *Crocodylus* and *K. molnari*, suggests that the insertion of this muscle may have been partially divided. As to whether such a division influenced the action of the muscle during contraction is unclear, and it may or may not be related to an interlocking occlusal pattern. The fact that a rostrocaudally divided retroarticular fossa is absent in several other taxa that possess an interlocking occlusal pattern (e.g., *Tomistoma schlegelii* and *Gavialis gangeticus*) suggests that this is not the case. It is hoped that the collection of further crocodylian material from the Rundle Formation will help elucidate any similarities between *Kambara* and crocodylids, shedding much needed light on the origins of mekosuchines.

ACKNOWLEDGEMENTS

We are grateful to Alex Cook and other staff in the Geosciences Program, Queensland Museum for access to material in their care. Further thanks must be given to the two anonymous reviewers of this report. Financial support for SWS at the University of Queensland was provided by the Australian Research Council Linkage-Project scheme (LP0347332), in association with the Queensland Museum, Land Rover Australia, Winton Shire Council and Isisford Shire Council.

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